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Absolute Light Intensity Measurements in Laser Induced Incandescence

Abstract

The invention relates to a method and an apparatus for the determination of particle volume fractions with laser induced incandescence (LII) using absolute light intensity measurements. This requires a knowledge of the particle temperature either from a numerical model of particulate heating or experimental observation of the particulate temperature. Further, by using a known particle temperature a particle volume fraction is calculated. This avoids the need for a calibration in a source of particulates with a known particle volume fraction or particle concentration. The sensitivity of the detection system is determined by calibrating an extended source of known radiance and then this sensitivity is used to interpret measured LII signals. This results in a calibration independent method and apparatus for measuring particle volume fraction or particle concentrations. A modeling process involves a solution of the differential equations describing the heat/energy transfer of the particle and surrounding gas, including parameters to describe vaporization, heat transfer to the medium, particle heating etc. The solution gives temperature and diameter values for the particles over time. These values are then converted to radiation values using Planck's equation.

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